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MULTI-CREWING USCG CUTTERS--HOW AND WHY

by

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December 1986

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T230370

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION Naval Postgraduate School 6b OFFICE SYMBOL (If applicable) Code 54	7a NAME OF MONITORING ORGANIZATION Naval Postgraduate School
6c ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000	7b ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000
8a NAME OF FUNDING/SPONSORING ORGANIZATION 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c ADDRESS (City, State, and ZIP Code)	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)
MULTI-CREWING USCG CUTTERS--HOW AND WHY

12 PERSONAL AUTHOR(S)
Eccles, Robert C.

13a TYPE OF REPORT	13b TIME COVERED FROM ____ TO ____	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Master's Thesis		1986, December	70

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Multi-Crewing; Implementing Organizational Change

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

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20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL Prof. Ben Roberts	22b TELEPHONE (Include Area Code) (408) 646-2792 22c OFFICE SYMBOL Code 54Ro

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted
All other editions are obsolete

#19 - ABSTRACT (CONTINUED)

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Multi-Crewing USCG Cutters--How and Why

by

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Lieutenant, United States Coast Guard
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1986

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I. INTRODUCTION

The United States military maritime services have traditionally manned their ships with one permanently assigned crew per vessel. Military aircraft, and small floating units (less than 65' in length) are routinely operated by any of a number of crews on any given day. The advantages of multi crewing are both basic and obvious. Once necessary maintenance and repairs have been performed, after a platform has completed a deployment or sortie, that resource is available for another mission if the people that man it are ready. In the case of some single-crewed ships, the duration of a typical mission is such that the one crew needs more time inport, before another extended absence is possible, than the amount of time needed for scheduled and after-action maintenance. During this time of necessary crew rest, the platform remains idle at the pier. The amount of additional time underway that could be acquired is a function of how much maintenance each vessel type demands. Certainly there are classes of single-crewed military ships in service today from which we are currently enjoying the maximum utility because of unavoidable maintenance constraints. It is equally as certain that there are also vessel types within our military fleet capable of providing additional utility by way of multi crewing.

Why, then, are some of our ships not multi crewed? We have, in the past, made temporary attempts with limited success. A brief history and description of these endeavors is offered in the next chapter. The operational feasibility of past efforts is well documented but, in the long run, frequently the concept is abandoned.

It is my hypothesis that the underlying, fundamental problem that limits the potential success of selective multi crewing of ships is common to any new approach to how we do things: resistance to change! This resistance comes in two forms, both of which, I believe, can be managed. First, the pride that develops between sailors and their ships results in a fierce hull loyalty. We have seen that, with proper leadership, this loyalty can be transferred to a crew, squadron, or division completely enough to experience no loss in proficiency or dedication. Second, among many of the individuals involved in surface operations, there exists the perception that the concept is neither workable nor supported. The reasons for this attitude are based upon inaccurate beliefs about the efficiency, productivity, maintenance, and morale of multi-crewed units. Contributing to the resistance created by these erroneous assumptions, is the apparent and recognized rejection of the concept by many members of the upper echelon. It is not so much this failure of management to get behind multi crewing that weakens it, as it is their tendency to get in front of it.

Support from upper management is not as critical to success as resistance is to failure.

In order to determine the performance of past multi-crewed vessels, research of historical data was conducted and compared to similar single-crewed units. Emphasis was placed on efficiency, productivity, maintenance, and morale. Interviews with crewmembers from two dual-crewed 82' patrol boats transpired in a further attempt to identify specific strengths and weaknesses unique to sharing a hull, and associated with the concept. Finally, a survey of ninety senior Coast Guard officers was taken to determine their perceptions about this type crewing configuration. Incidental to the senior officer survey, twenty-eight junior Coast Guard officers were surveyed at the Naval Postgraduate School to ensure the instrument was clear and unambiguous.

As was expected, multi-crewed vessels proved to be equally as productive and efficient as similar single-crewed units in one instance, and significantly more so in another. A review of required, annual inspection reports for similar units operating under each crewing configuration revealed no significant difference in how well the units were maintained. Finally, no untenable morale problems unique to multi crewing surfaced during the research. The majority of survey responses to questions on these issues were opposite to what, in fact, occurs. Particularly noteworthy was the widespread and accurate perception of most officers surveyed

that officers senior to them were opposed to the concept of multi-crewing ships. Frequently, this opposition was based on beliefs opposite that which historical research establishes.

The study that follows is presented in a manner that, hopefully, allows the reader to develop an understanding of how the concept of multi-crewing ships has evolved, and come to be viewed as it is today. First, a selective history of the concept, as recently applied by the United States Coast Guard, is offered to provide the reader with a knowledge of past multi-crewing efforts. Next, the methodology used to gather and analyze the data collected is covered, including a description of survey sample size and demographics. This information is followed by the presentation and interpretation of the data collected. The implementation problems associated with the concept of multi-crewing ships, that surfaced as a result of data gathering and interpretation, are then examined. Management and leadership alternatives that have promise of alleviating past shortcomings are then discussed. Finally, conclusions and recommendations are developed, including a brief, general description of how a viable squadron of several multi-crewed patrol boats might be organized.

Expanding Coast Guard missions call for expanded Coast Guard presence, and additional crews are far less expensive than additional ships and crews. Further, the flexibility

that multi crewing offers in terms of personnel absences for away-from-ship training or leave (vacation) is significant. Budgetary constraints may soon necessitate compromises in how we operate our vessels so as to gain additional utility and efficiency from the limited resources we currently employ. Today, these constraints preclude continued multi-crewing efforts but, imminently, the inherent practical and economic gains of multi crewing will dictate further attempts at it. I am convinced that resistance to change is the largest barrier to the permanent acceptance and establishment of multi-crewed ships. It is my hope that this thesis will serve as a source of historical data and research to be consulted when next we attempt to organize a squadron or division of multi-crewed vessels.

II. HISTORY

The U.S. Coast Guard has conducted numerous experiments, and commissioned many floating units, with multi-crewing organizations, particularly in the past ten years. A brief description of these efforts is useful for developing an appreciation of how the USCG approach to the concept has evolved.

A. THE WPB AUGMENTATION DETAIL

During the spring of 1980 a special operation was conducted in the Florida Straights that involved temporarily dual-crewing patrol boats that were normally single crewed. Approximately six 82' patrol boats homeported along the east coast of the United States were brought to Miami, Florida by their permanently assigned crews. The boats generally arrived in pairs, and each pair was involved in the operation for approximately three weeks. Two complete additional crews were formed by identifying qualified individuals throughout the Coast Guard, and bringing them to Miami for the duration of the eight week operation. Each of the two additional crews were assigned to each of the paired patrol boats. The intent of the operation was to temporarily generate a more frequent Coast Guard presence in and around the Florida Straights by increasing the utility of the vessels. Assigned crews would alternate manning the boats

for three day rotations. Once both the permanently assigned crew and the temporarily assigned crew had each completed two patrols, or every 12 to 15 days, the vessel would remain inport for five days maintenance. The project accomplished its purpose of increased Coast Guard vessel visibility in the vicinity of historically active drug delivery routes. More important to this thesis, while the brevity of the exercise left little time for generally espoused concerns regarding multi crewing to surface, as the Commanding Officer of one of the two relief crews, I recall that most of the participants in the operation very rapidly adjusted to the necessary sharing of units.

B. POLAR CLASS ICEBREAKERS

Our Coast Guard has, among other missions, the task of keeping waterways necessary for commerce free enough of ice to be navigable. The largest vessel within the U.S. Coast Guard fleet is the Polar Class Icebreaker, of which we have two. The development of these 399' ships took place in the mid-seventies. Normal ship's complement is 136 men and women, and a typical deployment is from two to five months, depending on where the vessel is bound for. Originally, the two ships were to be manned by three rotating crews. However, according to a representative of the Coast Guard's Office of Ice Operations (G-OIO) located at USCG Headquarters in Washington, D.C., personnel constraints precluded ever actually applying the concept. Moreover, as these

ships came on line, there were increasing concerns that they were more maintenance-intensive than originally expected. The advanced technologies and arduous environmental conditions under which these powerful icebreakers operate demand considerably more attention to maintenance than the time available for it in a multi-crewed configuration.

C. RIVER BUOY TENDERS

The late seventies brought a variation of multi crewing to a small segment of the Coast Guard's buoy tender fleet. The intercoastal waterways of the United States are comprised of rivers with navigable routes identified by buoys and markers. These particular aids to navigation are maintained by a fleet of small buoy tenders ranging in length from 65' to 115', with crew sizes varying from 12 to 22 people. According to a representative of the Coast Guard's Office of Navigation (G-NSR) at USCG Headquarters, during the late seventies the geographic areas of responsibility for 24 such Coast Guard cutters was redistributed among 18 ships, which were then each augmented with six to eight additional crewmembers. These vessels generally deployed for two weeks, followed by two weeks inport. Crew augmentation allowed most crewmembers to rotate remaining ashore every third patrol. A reduced number of vessels were maintaining the original number of aids to navigation by spending more time underway. Ultimately, the age of several of these buoy tenders

precluded continued high paced operations. However, 12 of the original 18 cutters still operate under this augmented organization today.

D. THE WPB DIVISION

One of the purest forms of multi crewing aboard ship was experienced during the period from 1981 through 1985 in Miami, Florida. Two 95' patrol boats were manned by three rotating crews. These two boats and three crews, augmented by an assigned ten person support staff, together formed the WPB Division. Normal crewing requirements for this type patrol boat consists of 12 to 14 men and women. However, the assigned shoreside support for inport periods allowed the cutters to operate with a crew of ten people. The primary missions of patrol boats are search and rescue, as well as law enforcement. This unique Patrol Boat Division was disbanded in early 1986 because, much like several of the augmented buoy tenders of the late seventies, the age of this type patrol boat precluded its extended use in such high-paced operations. The performance of the WPB Division is the subject of closer examination in Chapter IV.

E. THE SES DIVISION

Another effort at multi-crewing ships took place in Key West, Florida in 1982. Working in concert with the establishment of the U.S. Vice Presidential Task Force on Drugs, the USCG acquired three surface effect ships. These 110'

vessels represent state of the art technology in terms of patrol boat speed and stability. The three ships were manned by four rotating crews, each consisting of 14 to 16 men and women. Together with a shoreside support staff of approximately 20 additional people, the entire organization formed the SES Division. During the three years of the Division's existence, its operational success was demonstrated by the seizure of over 50 vessels laden with over 250,000 pounds of marijuana having a street value of approximately $100,000,000. Unfortunately, similar to the Polar Class Icebreakers, these vessels were found to be significantly more maintenance-intensive than envisioned and, as a result, in early 1986 the ships assumed the traditional single-crewing configuration. Aspects of the performance of these units are also reviewed in Chapter IV.

F. COSARFACS

A variation on multi crewing that minimizes the potentially adverse effects of several crews rotating through several vessels, particularly the loss of hull loyalty, is dual crewing. The WPB Augmentation Detail, previously described in Section A of this chapter, is an example of this approach. A more extended effort at this concept was accomplished along the west coast of the United States during the decade from 1975 to 1985. Seven 82' patrol boats, each normally manned by a single crew of eight to nine men, were dual-crewed. These units were each then

referred to as a Coastal Search and Rescue Facility (COSARFAC). A close examination of the performance of these organizations is offered in Chapter IV. A representative of the U.S. Coast Guard's Office of Operations (G-O) identified developing personnel shortages as the primary catalyst for the recent shift back to single crewing by these units.

G. INTERNATIONAL--SMALL NATION NAVIES

Many countries throughout the world have a limited need, or economic ability, to develop a large naval force. Two examples of this situation are described. The information offered suggests that many of the problems associated with the concept of multi-crewing vessels may not exist, or surface, prior to experience with single crewing.

1. The Republic of Sierra Leone Military Forces

Sierra Leone is a small country located on the west coast of Africa, approximately 400 miles north of the equator. This politically neutral nation received its independence from Great Britain in 1961, has a population of 3,000,000 people, and is comparable in size to North Carolina. Sierra Leone's military has a maritime branch currently consisting of approximately forty men, and one 65' patrol boat. The normal manning of this vessel consists of one officer and eight or nine enlisted men. Therefore, the three officers of the naval branch alternate operating the vessel with whichever of the four possible crews is assigned that duty on any given day. Generally, core crew stability

is maintained. However, occasionally crew members alternate from one group to another to facilitate coordination of necessary, individual absences. During an informal conversation with Lieutenant Mohammad Diaby, operations officer of the RSLMF Navy, maintenance and morale issues associated with the multi-crewing concept were discussed. Mr. Diaby felt that crew rotation offered significant advantages in terms of flexibility. He indicated he had experienced no perceivable adverse impact on unit effectiveness that resulted from lack of hull loyalty or ownership. When asked if the service would adopt single crewing at its first opportunity, LT Diaby expressed doubt. Noting that his navy had never permanently assigned any single crew to a vessel, he knew of no reason to do so.

2. The Grenada Coast Guard

Grenada, one of the island nations in the Caribbean Sea, has a situation similar to that of Sierra Leone. Having achieved its independence from Great Britain in 1974, this ex-colony espouses a foreign policy of non-alignment. Grenada has a land area of 133 square miles, and a population of approximately 100,000 people. Their Coast Guard is currently operating a 109' patrol vessel and two 30' boats by rotating their 25 member force through the various hulls. During recent onsite observations of this operation, and after discussions with Grenada Coast Guard members, no significant barriers or hindrances to unit effectiveness

were identified that could be attributed to their multi-crewing approach.

Thus it would seem a person's position on multi crewing depends largely on their experience with single crewing. Further, if their belief is that a multi-crewed vessel will not perform as well as a single-crewed vessel because they predict maintenance and morale will suffer for lack of vessel ownership, then this resistance to the concept is based on erroneous perceptions rather than a rational, objective evaluation.

H. USN FBM SUBMARINES

The Unites States Navy has dual-crewed fleet ballistic missile submarines from the time of their conception, beginning in the early 1970s. This researcher communicated by letter and telephone on several occasions with Submarine Group Nine, located at the Bangor Naval Submarine Base in Bremerton, Washington. It was my intent to visit this facility and examine more closely their approach to implementing the concept of multi-crewing submarines, as well as interview several crewmembers to determine their reaction to sharing a hull. Unfortunately, I was unable to gain access to these resources. One reason offered by a representative of the organization was that any such visit might interfere with ongoing preparations to meet future operational commitments. It is felt that these units are a rich source of data and experience concerning multi-crewed vessels. The

history and performance of USN FBM submarines regarding multi crewing is suggested as an area for further research.

III. METHODOLOGY

Establishing the existence of resistance to the concept and implementation of multi-crewing vessels involved a simple two step approach. First, a review of previous multi-crewed USCG cutter organizational efforts served to provide cost and productivity data for comparison with similar single-crewed vessels. The fact that one or more of these multi-crewed organizations proved to be more cost effective than a similar single-crewed unit, but that the multi-crewed organizations were ultimately disbanded, suggests that there is lack of support for the concept. The second step, after determining the existence of resistance to the concept, was to identify the origins of this apparent rejection.

The hypothesis for the thesis assumes that erroneous perceptions exist, on the part of mid and upper level decision makers, about the efficiency, productivity, maintenance and morale of multi-crewed vessels, and that these negative attitudes are influenced by those of their seniors. Verification of these assumptions was accomplished by identifying and surveying those upper echelon operations and staff elements that would have the most impact on multi-crewed vessel administration. The targeted population of mid and upper level managers whose perceptions were sought included each

Commanding Officer, or his representative, of all USCG 378' high endurance cutters, as well as 270' and 210' medium endurance cutters. Appendix A, which was developed by LCDR M.J. Pierce USCG and LCDR R.L. Porter USCG [Ref. 1:p. 37], depicts the U.S. Coast Guard Organization in terms of geographic areas of responsibility. Office chiefs, or their representatives, at the Headquarters level that were surveyed included the Offices of: Operations (G-O), Law Enforcement (G-OLE), Search and Rescue (G-OSR), Personnel (G-P), Enlisted Personnel (G-PE), Officer Personnel (G-PO), Engineering (G-E), and Naval Engineering (G-ENE). Office chiefs, or their representatives, at the Area level that were surveyed included the Offices of: Operations (AO/PO), and Operations Center (AOC/POC). Office chiefs, or their representatives, at the District level that were surveyed included the Offices of: Operations (o), Search and Rescue (osr), Intelligence and Law Enforcement (oil), Safety (dso), Inspection (di), and Operations Readiness (or).

A total of 100 surveys were distributed, of which 75 were returned with useful responses. The level of interest and participation was encouraging and appreciated.

IV. WHAT'S THE PROBLEM?

In order to compare levels of productivity, efficiency, maintenance, and morale between single-crewed and multi-crewed vessels, a three pronged approach to data gathering was taken. First, historical data covering the performance of three different crewing configurations was reviewed. Next, interviews with crewmembers from dual-crewed vessels were conducted. Finally a survey of senior Coast Guard officers currently assigned to staff positions that impact on floating unit administration was taken. The purpose of the survey was to determine perceptions about the issues covered in the historical research, and to take a measure of how the respondents believed officers senior to them felt about the multi-crewing of vessels.

A. HISTORICAL RESEARCH

1. 82' WPBs

A comparative analysis was conducted between single-crewed 82' WPBs and dual-crewed 82' WPBs (COSARFACs). The annual operating costs and actual hours underway over a two year period for thirteen units, six conventionally crewed 82' WPBs and the seven COSARFACs, was obtained. All thirteen vessels studied were stationed along the California coast between Eureka to the north and San Diego to the south. Data from fiscal years 1984 and 1985 was used

because that information was recent enough to be topical in terms of mission demands. A two year time frame was decided upon to ensure all significant operating cost items and events that limited vessel availability, for example biennial yard periods, were taken into account. Operating costs were obtained from the annual summary of Operating Costs of Coast Guard Cutters provided by the Office of the Comptroller, Accounting Division (G-FAC-6), Coast Guard Headquarters, Washington, D.C. These costs included military pay and allowances, operating maintenance costs and fuel, electronics program updates, vessel program updates, and miscellaneous costs. The number of hours underway for each unit was acquired from the annual summary of Operational Statistics provided by the Office of Operations, Plans and Programs Staff (G-OP). Table I of Appendix B reflects that the average number of hours underway annually during fiscal years 1984 and 1985 for the six single-crewed 82' WPBs studied was 1,017 at an average annual cost of $331,219. The resulting cost per hour underway for this type unit was $325.68. The seven dual-crewed platforms proved significantly more productive and efficient, with an average number of hours underway annually during FYs 84 and 85 of 2,182.3 at an average annual cost of $302,888. The resulting cost per hour underway for this type unit was $138.79. The fact that the average annual operating costs for a patrol boat with a smaller crew and less than half as many average

annual resource hours was higher than for the dual-crewing configuration necessitated a closer examination of the breakdown of costs. The average annual maintenance costs for the single-crewed boats was 44% higher than for the dual-crewed boats, and vessel program update costs were 84% higher. Generally, vessel program updates are scheduled independent of annual cutter operations, and not a function of crewing configuration. However, even after eliminating the approximate $25,000 additional cost per single-crewed hull for this expense, the dual-crewed vessels cost slightly less to operate per year and are more than twice as productive. Overall, the data suggests that, if the productivity and efficiency differences between the two crewing configurations that occurred along the California coast applied nationwide, had all 52 of the 82' WPBs in service in FYs 84 and 85 been dual crewed, then the total resource hours for this type unit would have more than doubled (increased by nearly 115%) for approximately $300,000 less than the total two year cost that was actually incurred.[1]

The survey results, which will be reviewed in detail in Section B of this chapter, indicated increased maintenance is an area of primary concern that would serve to hamper and negate the positive impact of the additional

---

[1]Actual Annual Costs:

		Potential Annual Costs:	
7 COSARFACs	$2,120,169	52 COSARFACs	15,750,197
45 s/c 82'	13,779,855	($331,219 - $25,000 x 45)	
	$15,900,871		

Difference = $148,874 x 2 years = $299,748

hours underway experienced by rotating crews. However, a review of the operational statistics for FYs 84 and 85 for the thirteen 82' WPBs studied does not substantiate this phenomenon. Specifically, as reflected in Figure 1, the six single-crewed units required an average of 2,643.8 hours of maintenance per unit in order to accomplish their average of 1,017 hours underway annually, or 2.6 hours of maintenance for each hour underway. The seven dual-crewed units required an average of 2,603.6 hours of maintenance to accomplish their 2,182.3 hours underway, or 1.19 hours of maintenance for each hour underway. This increased opportunity for maintenance enjoyed by the single-crewed 82' WPBs may provide constructive employment for the crew while inport, but does not appear to be necessary to increase the utility of the platform.

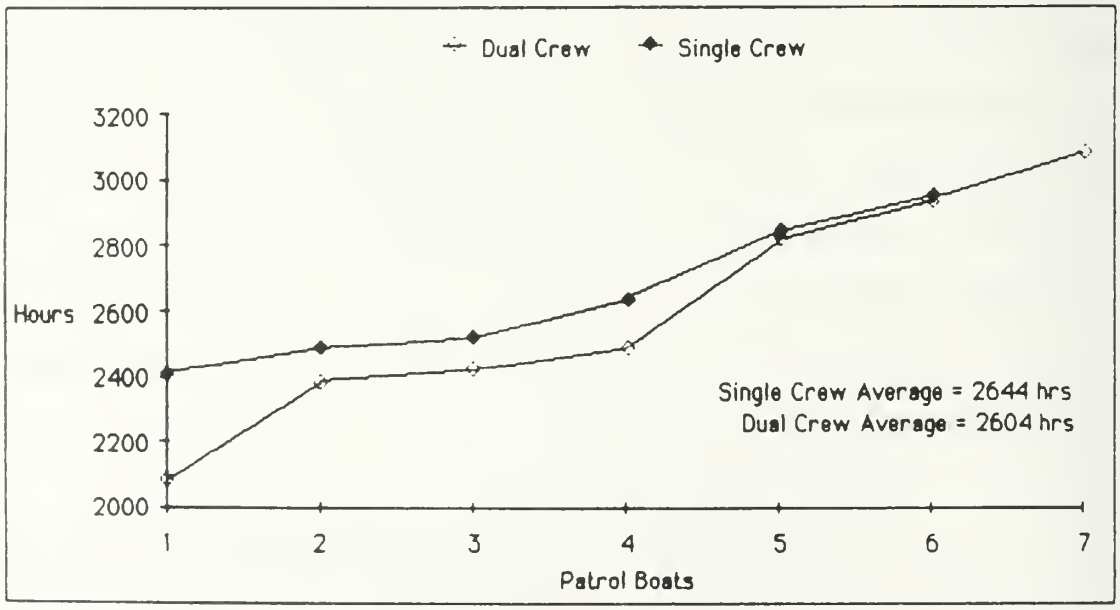

Figure 1. 82' WPB Maintenance Hours--FYs 84/85

An additional concern expressed during the survey was that vessel maintenance and appearance would suffer for lack of the hull loyalty experienced with single-crew unit ownership. However, a review of the annual District Inspection results for FY 85 for the thirteen 82' WPBs studied failed to show any significant differences in either overall maintenance or appearance between the two crewing configurations. In fact, as reflected in Table II of Appendix B, the dual-crewed units achieved slightly higher average ratings in every category.

It is beyond the scope of this thesis to review the productivity, efficiency, and maintenance records of the thirteen units studied over the approximate ten year history of the COSARFACs. It is the opinion of this researcher that such a study would support the findings of this paper. Concern expressed in the survey over long run unit deterioration aboard multi-crewed units due to poor maintenance, for lack of ownership, appears unfounded. Even if there is some merit to this concern, the level and pace of that deterioration would not seem to outweigh the significant increases in efficiency and productivity enjoyed by multi crewing.

2. 95' WPBs

A comparative analysis was conducted between the WPB Division and similar single crewed units in the same geographic area. The WPB Division, which was homeported in Miami, Florida, consisted of two 95' WPBs manned by three

rotating crews. Two single-crewed 95' WPBs homeported in Key West, Florida were identified as units with geographic areas of responsibility and mission requirements similar enough to make a comparison reasonable. Data from two years, FYs 84 and 85, was collected and analyzed. Table I of Appendix B reflects that the average number of hours underway annually during FYs 84 and 85 for the two single-crewed 95' WPBs was 2,372, at an average annual cost of $395,585. The resulting cost per hour underway for this type unit was $166.77. The average number of hours underway annually for the two multi-crewed 95' WPBs was 2,282, at an average annual cost of $448,823. The resulting cost per hour underway for this type unit was $196.68, or approximately $30 more per hour for the multi-crewed vessels. It should be noted that the number of resource hours accumulated during FY 85 for one of the multi-crewed 95' WPBs studied, the Cape Gull, was significantly reduced by extended maintenance. However, even if the Cape Gull had achieved a more typical underway profile during FY 85, the cost per hour comparison between single-crewed and multi-crewed 95' WPBs in the southeastern United States suggests that this type patrol boat is not significantly more efficient or productive when multi crewed.

Slight vessel appearance and maintenance differences for the two crewing configurations were noted in the FY 85 District Inspection results reviewed. Specifically, as

reflected in Table II of Appendix B, the material inspection and naval engineering scores for one of the three crews that comprised the WPB Division were rated 'good.' This is an acceptable level of performance, but below average relative to all other units studied. According to the senior member of the inspection party, an O6, the two remaining crews in the Division achieved 'excellent' scores in these categories because "a well motivated crew can achieve with guidance and encouragement (leadership)." The subpar performance of the one crew is, therefore, attributed to less than adequate guidance and encouragement, vice loss of hull loyalty due to lack of ownership. Chapter V will examine the impact of leadership in detail.

The specific explanation for the better economies enjoyed by dual-crewed 82' WPBs, but not experienced by multi-crewed 95' WPBs, was examined. Two significant differences between the platforms are vessel age and ownership. The 95' WPBs are approximately eleven years older than the 82' WPBs and, therefore, may possibly not be able to accomplish more than 2500 hours underway per year regardless of how they are crewed. Their larger crew complement, as compared to an 82' WPB, allows the single-crewed 95' WPB to obtain as many hours underway annually as a multi-crewed 95' WPB might in the same geographic area and with the same mission. The second major difference between the dual-crewed 82' WPB and the multi-crewed 95' WPB is crew

affiliation with a particular hull. The dual crews of the 82' WPBs did not alternate among platforms, as did the three crews of the 95' WPB Division. The issue of ownership/hull loyalty, and its effect on appearance and maintenance, was examined by comparing annual inspection results. Significant differences between single-crewed and multi-crewed units were not observed.

3. The SES Division

A study of the SES Division, homeported in Key West, Florida, was made in an attempt to further determine the impact on maintenance and appearance of crews rotating among hulls, as well as to further establish vessel age as a primary factor explaining productivity differences between multi-crewed 82' and 95' WPBs. The Surface Effect Ship Division was comprised of three 110' vessels with primary missions and standard crewing requirements similar to that of a 95' WPB. Much like the WPB Division, the WSESs were manned by rotating four crews through the three hulls to increase platform productivity. The average number of hours underway annually for each of the three WSESs during fiscal years 1984 and 1985 was 2,311. This figure is deceptively low as all three vessels underwent extended maintenance periods to accomplish extensive changes to their physical layout during the period. The SES Division averaged 232 annual maintenance days per unit during FYs 84 and 85, including approximately 70 maintenance days each for vessel

retrofit. The WPB Division averaged 159 annual maintenance days per unit during the same period. This means that the multi-crewed WSESs were approximately 30% more productive, as measured by actual hours spent underway when available, than the multi-crewed 95' WPBs. The analysis tends to verify that maintenance demands, as dictated by vessel age for the 95' WPB, or technology for the WSES, appears to be the limiting factor in how much utility can be expected from these two vessel types. Once again, a review of the FY 83 annual inspection report for the WSESs did not reveal any substandard appearance or maintenance. Specifically, the SES Division received an overall evaluation of 'outstanding,' the material condition of the cutters was determined to be 'outstanding,' the naval engineering function was rated 'excellent,' and an 'outstanding' score was achieved on the personnel inspection. I was unable to substantiate the development of apathy or procrastination, leading to poor vessel maintenance or appearance because of loss of hull loyalty, stemming from the absence of one crew to one vessel ownership. Concern over this issue is frequently, and understandably, expressed during inquiry, but the phenomenon is not apparent in reality.

B. THE SURVEY

Logically, critical measures of unit performance involve productivity, maintenance, morale, and efficiency. The survey included questions to determine each respondent's

perceptions of how multi-crewed vessels compared to single-crewed vessels on each of these measures. An additional area of research interest concerned to what extent the respondent's support of, or opposition to multi crewing was influenced by their perceptions of how officers senior to them felt about it. Finally, each respondent was asked to indicate their own feelings about the concept.

Appendix C is a copy of the survey instrument. Based on the responses provided, a statistical analysis of the data was conducted by treating questions 8, 9, 10, 11, and 17 as predictors, or independent variables. These questions covered respondent perceptions of the comparison between the two crewing configurations on the critical measures of unit performance described, and perceived upper echelon support or opposition to the concept of multi-crewing vessels. Question 13, which asked the respondents' own position on the issue, was then used as the criterion, or dependent variable. Responses of A or B to predictor questions 8, 9, 10, and 11 were assigned a value of 1, meaning supportive, and a C response was assigned a value of 2, indicating opposition. A response of A, B, or C to questions 13 and 17 translated to a value of 1, while a D or E response rated a 2. Table III of Appendix B presents the data in the described format. An accurate prediction of how each respondent feels about multi-crewing vessels can be made 78% of the time by simply observing which of the values, 1 or 2, is

more prevalent among the five predictors. This is significant because the best that could be expected randomly is 50%.

Correlations between each independent (predictor) variable and the dependent (criterion) variable, as well as among the independent variables, are presented in Figure 2.

Subject	Productivity	Maintenance	Morale	Efficiency	Seniors	Opinion
	Pred Q8	Pred Q9	Pred Q10	Pred Q11	Pred Q17	Crit Q13
Productivity	1.000	0.324	0.310	0.415	0.214	0.260
Maintenance	0.324	1.000	0.502	0.407	0.447	0.489
Morale	0.310	0.502	1.000	0.185	0.306	0.640
Efficiency	0.415	0.407	0.185	1.000	0.118	0.328
Seniors	0.214	0.447	0.306	0.118	1.000	0.255
Opinion	0.260	0.489	0.640	0.328	0.255	1.000

Figure 2. Correlation Matrix for Predictor and Criterion Variables

Correlations between .3 and .7 are considered moderately strong enough to infer the possibility of causal relationships. The data displayed in Figure 2 serves to rank-order how much respondent perceptions about each measure of unit performance, and perceived upper echelon support or opposition to multi-crewing vessels, impacts on their opinion of the concept. As can be seen, respondent perceptions of how morale and maintenance aboard multi-crewed vessels compares with that aboard single-crewed vessels correlates highest with their declared position, supportive or opposed, on the issue of multi crewing. It is also interesting to note that the correlation between these two variables, .502, is the

highest among the predictors. This suggests that maintenance is affected by morale, which seems quite reasonable. The historical research previously discussed indicates the level of maintenance aboard multi-crewed vessels is equal, if not superior, to that found aboard similar single-crewed units. Perceptions about efficiency are also above the .3 correlation hurdle for affecting opinion. Feelings expressed by respondents regarding productivity comparisons between the two crewing configurations, and the impact of perceived senior officer viewpoint, are less significant, but do approach correlation levels indicative of a possible causal relationship between these predictors and the criterion question of opinion.

A stepwise linear regression of the data was also run, using the standard levels of acceptable entry and exit for each independent variable into the proposed model, to arrive at a formula that would explain as much of the variance among the predictors and criterion as possible. This approach identified morale and efficiency as the two independent variables that, when combined, best predict opinion. This information is displayed in Table IV of Appendix B.

Perhaps the most interesting outcome revealed by the statistical analysis is that, of the 78% of those surveyed about which a correct prediction can be made regarding their support of, or opposition to, multi-crewing vessels, 56% of those in opposition to the concept reach their conclusion

armed with erroneous assumptions about two or more of the five predictor variables. Certainly, it is reasonable to assume that multi-crewed vessels have enjoyed reduced support as a result of this phenomenon, and to expect that these organizations have not yet been able to fully demonstrate their potential utility and effectiveness.

C. THE INTERVIEWS

In an effort to further identify the strengths and weaknesses associated with the concept of multi-crewing vessels, and to determine to what extent these characteristics can be manipulated so as to maximize the advantages and minimize the problems inherent with the concept, individual interviews were conducted with COSARFAC crewmembers. Two dual-crewed 82' WPBs were visited in Los Angeles, California. Four crewmembers from each unit participated in the research. The interviewees included the Commanding Officer, as well as senior and junior enlisted personnel from both the engineering and hull maintenance departments. The variation in time aboard the units ranged from three to twenty-four months among the eight participants, with the average being 13.6 months.

There were five questions in particular that covered the issues of central interest to the thesis. A discussion of some specific, and general responses follows.

1. Strengths

What is going well with your crewing configuration? What are its strengths, the positive qualities?

All eight respondents identified additional free time, relative to the long hours demanded of crewmembers aboard conventionally manned vessels, as the greatest advantage of multi crewing. The additional manpower available aboard multi-crewed units was also universally mentioned. There was a consensus among the interviewees that the platform is better maintained and more productive as a result of having more personnel. Among the more senior participants in the interviews, the higher experience level of the crew that existed because of the larger crew size was identified as an advantage of multi crewing. Finally, one senior enlisted interviewee pointed out that fatigue, resulting from extended operations, was reduced because of the relief available by way of crew rotation.

2. Weaknesses

What is not going well with your crewing configuration? What are the problems, concerns, and issues?

Consistency and uniformity surfaced as the central issues in response to this question. Anything less than full crew reliefs results in inequities that lead to frustration and dissatisfaction. Poor communications and incomplete briefings during actual crew rotation results in inefficient or redundant work distribution. Issues includ-

ing unclear authority and responsibility were identified. Also mentioned by two enlisted interviewees was conflict that surfaces when distinct separation between crews exist, resulting in levels of training differences, and unhealthy competition. Many of the survey respondents expressed concern that multi crewing a vessel would negatively impact on unit esprit de corps. Interviewees acknowledged that there is a limited amount of conflict between crews regarding work responsibilities, but indicated that the frequency of such disagreements was comparable to similar incidents aboard single-crewed vessels. Moreover, interviewees generally felt that all unit personnel, together, formed a cohesive team. As a further check on the need for extended team building when employing the multi-crewing concept, an approach developed by W.G. Dyer [Ref. 2:pp. 27-40] was used. Employing Dyer's checklist, which was designed to measure the extent of unit problems involving such issues as conflict, apathy, and trust, little evidence surfaced to suggest that the multi-crewed units visited were less team oriented than single-crewed vessels. The success of developing team spirit aboard multi-crewed vessels appears similar to that of conventionally crewed units. Unique to the COSARFACS, but along the lines of equity and consistency, was the universal concern expressed by crewmembers of pay and commissary privileges not enjoyed in their organization that are standard benefits aboard single-

crewed vessels. This is due to legislation and regulations that are currently worded in a way that precludes providing these benefits to vessels that are not manned and operated in the standard fashion.

3. Objectives and Goals

What is the purpose of your crewing configuration (goal, objective)? Is it clear?

None of the interviewees were aware of any official answer to this question. All responses were qualified as a guess, and included reducing fatigue and increasing unit productivity as the purpose of multi crewing. It is interesting to note that, while the purposes cited are chief among the intended accomplishments of the multi-crewing concept, no crew member had ever actually been told that. One junior enlisted respondent was not aware that all 82' WPBs were not dual crewed until several months after reporting aboard the unit.

4. Perceived Upper Echelon Attitudes

How do you think people senior to you feel about this crewing configuration?

The general consensus among those interviewed was that people senior to themselves in the chain of command provide the level of support deemed necessary and expected by the upper echelon. Interviewees, as a group, had no strong sense of upper echelon favor or opposition to the concept. However, while the majority of answers to this

question were as described, there were several individual responses, covering all levels of unit hierarchy, expressing a perception of upper echelon favor with the concept, or a clear feeling of management opposition to multi-crewing vessels. Again, no trend that could be correlated with such variables as paygrade or experience was observed.

5. Job Satisfaction

How do you compare this crewing configuration to single-crewed platforms in terms of job satisfaction?

A slight majority of those interviewed declared single crewing as being more satisfying in terms of authority and responsibility. The most frequently mentioned reasons for this response included many of the factors identified as weaknesses with the multi-crewing approach to manning vessels, specifically, lack of consistency, due primarily to failure to clearly identify and assign areas of responsibility and ownership to specific, designated personnel. Respondents generally agreed that the increased manpower of multi crewing provided significant rewards (additional free time and productivity) that, if properly organized and managed, made multi crewing the more desirable crewing configuration. Individually, each interivewee declared that they would have no problem with working in a properly managed, multi-crewed, multi-vessel organization, however, many interviewees expressed doubt as to whether others could function under the concept.

D. SUMMARY

The historical research conducted establishes that the 82' WPB performs significantly better in terms of productivity and efficiency when multi crewed. The 95' WPB and the 110' WSES do not exhibit higher levels of performance on these measures when multi crewed, due to the maintenance demands of vessel age and technology, respectively. There is no appreciable difference between single and multi crewing in terms of maintenance or morale aboard any of the vessels studied.

The results of the survey conducted indicate most upper echelon staff managers, in position to provide guidance and support, have erroneous, negative perceptions about the performance of multi-crewed vessels, compared to single-crewed vessels, regarding the four areas used to measure performance (productivity, efficiency, maintenance, and morale).

Interviews of crewmembers from dual crewed vessels revealed an organizational approach to multi-crewing that has been both vague and inconsistent.

It seems clear that the success of multi-crewing has been limited by the weaknesses identified through the research conducted.

V. WHAT'S THE SOLUTION?

The research effort outlined in Chapter III and described in detail in Chapter IV has identified several areas of concern that have surfaced as major obstacles to the successful, permanent implementation of the concept of multi-crewing vessels. These shortcomings include information sharing and communications, organizational planning, leadership, and vessel reliability and maintainability. The field of Organization Development (OD), which deals primarily with facilitating organizational change, is rich in techniques, principles and practices designed to cope with the kinds of problems that have limited the potential utility of multi crewing. This chapter will examine a few of these OD fundamentals. Additionally, a brief discussion is offered declaring high reliability and low maintenance as a must for a vessel to be suitable for multi crewing.

A. PLANNING, ORGANIZING, LEADING AND CONTROLLING

The research has clearly established that many decision makers have erroneous perceptions about multi-crewing vessels regarding productivity, efficiency, maintenance, and morale. Further, there exists a high correlation between their beliefs on these measures of performance, and their position, supportive or opposed, on the concept. Finally, the resulting general upper echelon lack of enthusiasm for

the crewing configuration is both flagrant and common knowledge.

The cause of these misunderstandings can be directly attributed to a lack of accurate information, i.e., communications. James F. Stoner [Ref. 3:p. 8] has written a popular text on the fundamentals of management in which he describes the management process, as originally defined over a century ago by the founder of the classical management school of thought, Henri Fayol, as consisting of planning, organizing, leading and controlling. His approach to management is founded in pursuit of accomplishing proper levels of these attributes to achieve organizational goals. The similarity between Stoner's elements of management, and the weaknesses identified by way of the research conducted on multi-crewing vessels is startling. The need for clear and complete information sharing and communications is essential to carrying out these four management functions. Decision-makers and participants involved in the implementation of multi-crewing vessels should be aware of the economic advantages and flexibility inherent in the selective application of the concept.

Once armed with accurate information, consequently dispelling many of the misgivings that currently exist about multi crewing, a change in leadership attitude is a reasonable expectation. The impact of leadership behavior on the implementation of change is well documented. Warren Bennis

and Burt Nanus [Ref. 4:p. 33] point out that "Success requires the capacity to relate a compelling image that induces enthusiasm and commitment in others." Military managers must not only possess a belief in the possibilities of the concept of multi-crewing vessels, they must be willing and able to effectively communicate and foster that belief to, and among their subordinates. Edgar H. Schein [Ref. 5:pp. 9, 313] has written a great deal on the culture of organizations. He defines culture as:

> a pattern of basic assumptions--invented, discovered, or developed by a given group as it learns to cope with its problems of external adaptation and internal integration--that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.

Schein emphasizes that much of an organization's culture is established by its leaders. Noel M. Tichy [Ref. 6:p. 269] also recognizes the leader's influence on an organization's culture. "Whether chief executives intend it or not, they have a strong impact on the culture of the organization." Many examples of the influence of leaders on the culture of organizations are cited by Thomas J. Peters and Robert H. Waterman, Jr. [Ref. 7:pp. 167-168, 13-16], not the least of which are frequent references to the ongoing impact of the late Walt Disney on the operations of the Disney empire. Two of the eight basic principles Peters and Waterman cite as being critical to organizational success, productivity through people and simultaneous loose tight properties, both

refer to creating and fostering an awareness of, and dedication to, the central values of the company. A more topical example of a leader's influence on his subordinates is the experience of Lee Iacocca [Ref. 8:pp. 144-250]. In Mr. Iacocca's autobiography, he describes how he was able to enlist the support of his employees, and achieve remarkable concessions from both government and labor, by successfully relating to them his knowledge and vision of what Chrysler Corporation was capable of, and ought to be. The United States Coast Guard has recognized the value and influence of leadership aboard ship by widely disseminating copies of the Excellence in the Surface Coast Guard, M.S. Thesis, jointly completed by LCDR Michael J. Pierce, USCG,and LCDR Robert L. Porter, Jr., USCG [Ref. 1:pp. 5-7]. These gentlemen established, through officer and crewmember shipboard interviews, that the Commanding Officer sets the tone for how aggressively and enthusiastically personnel will pursue unit goals and objectives.

There is no doubt that efforts directed toward the successful and extended implementation of multi crewing aboard vessels have been hampered by the effect on subordinates of leadership behavior that suggests a lack of support or belief in the concept.

Inequities and lack of specific guidance repeatedly surfaced as the theme in response to questions during the interviews that transpired with the Commanding Officers and

crews of two dual-crewed vessels. An examination of the Organization and Regulations Manual for Patrol Boat WPB (82') (CG-260-6) revealed that the dual-crewed platforms of this type vessel had received and inserted a ten page amendment to the basic manual several years after the concept had been implemented, the purpose of which was to establish the basic guidelines for the dual-crewing organization. The amendment revised general billet assignments, and briefly outlined specific duties for special evolutions. The original Organization Manual was, of course, written for a conventionally crewed 82' WPB. Beyond the fact that the amendment to the manual was painfully slow in coming, the brevity of the revision simply did not parallel the magnitude of the organizational change. There is no structural difference between a single-crewed and dual-crewed 82' WPB in a material sense, but in terms of organization the change is profound. In the absence of specific guidance, lines of authority and responsibility can become vague due to the duplication of crew positions inherent in the multi-crewing concept. Interviews and observations aboard the two dual-crewed vessels visited revealed most participants were responding to the demands of, or seeking information from, the two individuals senior to them that filled the one billet aboard the unit. Ultimately, that led to conflicting guidance or duplication of effort. The Organization Manual for a multi-crewed vessel should

eliminate the possibility of confusion over authority and responsibility by assigning specific areas of ownership and accountability to the single most senior member of each department among all the crews combined. This individual can then answer inquiries and coordinate department work assignments and scheduling so as to maximize the efficient use of available resources and, more importantly, minimize confusion, repetition, and lack of clarity. A brief addition to an organization manual designed for use aboard a conventionally crewed vessel simply does not cover the myriad of issues involved in so drastic an organizational change as the shift to multi crewing.

The historical research conducted verified that the decision to multi-crew selected Coast Guard vessels was reached only after careful consideration, but that the actual implementation of the concept was less than well planned. The need for advanced planning prior to implementing a major organizational change cannot be overstated. Mr. Tichy [Ref. 6:p. 335] offers a set of guidelines to assist leaders in managing the transition to a desired new organizational state. Chief among his suggested steps is a view towards the impact of a proposed change, and the development of a plan to manage the consequences. Specifically, Tichy recommends a review of the current organizational state, and an examination of the strategy intended to implement the desired new state. Potential

problem areas should surface by projecting the change into the unit's leader, follower, and task accomplishment arenas. As possible areas of conflict or confusion are identified, organizational adjustments can be planned and made to deal with those issues. Coping with what is different after an organizational change is not enough. An integral part of planning to implement the change from single to multi crewing, is consideration given to what should remain the same. Dual-crewmember interviewees were most vocal about dissatisfaction with the loss of seapay and the absence of a standard, operating shipboard dining facility. Steps should be taken to alter regulations and enact legislation that would eliminate such compensation and welfare inequities.

B. VESSEL RELIABILITY AND MAINTAINABILITY

Equally as important to the success of a vessel multi-crewing effort as organization, is implementing the concept on a platform suited for it. Multi-crewing in both the 95' WPB Division and the SES Division failed due to these vessel types being more maintenance intensive than the high paced operations of a multi-crewing organization allow. The extent of preventive and spontaneous maintenance required by a vessel, as indicated by past performance or manufacturer expectations, needs to be low and stable. A careful analysis of historical or probable maintenance demands is required prior to attempting to multi crew any particular vessel type.

VI. RECOMMENDATIONS

All other things being equal, single crewing is preferable to multi crewing. The fact is, a single-crewed vessel is an easier organization to manage. This is not to say that multi crewing is unmanageable, but simply to recognize that multi-crewed vessels present participants with unique organizational and leadership challenges. As it happens, for many of our U.S. Coast Guard cutters, all other things (mission, resources) are not equal. The nature of our law enforcement, and search and rescue missions frequently requires a rapid and sustained response capability that is difficult to meet in geographic areas where our presence is limited, or the demand is high. Another unequal 'other' is the increasing Congressional scrutiny of costs that continues to result in ever tighter budgetary constraints.

One way to deal with the growing need to become more efficient, is to identify and apply procedures designed to gain more utility from our resources. The implementation of multi-crewing aboard selected Coast Guard vessels has promise of meeting this need.

A. WHICH SHIPS TO MULTI CREW?

Many types of USCG cutters may be well suited for utilizing the multi-crewing concept. Any vessel type that is not maintenance intensive, has an established record of

reliability, and is tasked with a primary mission which calls for an unusually high level of underway operations, is suitable for use in a multi-crewing organization. This is particularly true of the 82' WPB. The research data collected and reviewed strongly indicates that this vessel has a known and stable maintenance and performance history, suggesting that the platform is capable of providing significantly more utility than its current, average rate of employment accomplishes. The limiting factor has been crew endurance. Dual-crewed 82' WPBs and/or multi-hulled divisions (squadrons) of this vessel type should be organized and employed in any geographic area where the magnitude of mission demands is great enough to justify such action. Another potential multi-crewing candidate is the 110' WPC type patrol boat. Once enough maintenance data has been accumulated to verify that this vessel is capable of providing resource hours beyond that which a single crew can reasonably accomplish, the platform should be organized employing the multi-crewing concept. The 210' medium endurance cutter may qualify for use in a multi-crewed organization. These vessels are the Coast Guard's off-shore work horse for extended law enforcement patrols in the southeastern United States. A study should be made to determine if the vessel's reliability and maintainability is such that multi-crewing selected ships of this vessel type is feasible and practical. The same potential for multi

crewing exists aboard the Coast Guard's icebreakers, buoy tenders, high endurance cutters, or any vessel type with mission demands that justify the use of the concept, and a low enough level of maintenance requirements to make it possible.

B. THE MULTI-CREWING ORGANIZATION

The purest form of multi-crewing vessels, as opposed to dual crewing, involves rotating three or more crews through two or more hulls. The WPB Division and WSES Division were examples of this approach. Any time that one of the vessels in the squadron is moored at its homeport, two crews would be available to perform necessary maintenance. In the case of patrol boats, as many as four hulls using six crews could be organized into a division. Larger vessels may need to be in a multi-crewed organization limited to two hulls and three crews, to keep logistics and coordination manageable. The basic mode of operations for these organizations when vessels are inport is to have all division members attached to their respective departments (engineering, deck, operations, or administration) for daily work assignments. Division members are assigned to specific crews for underway purposes, although vessel operations and crewmember training could become so standardized as to make crewmember rotation among crews possible. However, core crew stability may have advantages in terms of consistency and predictiveness that outweigh the increased flexibility available with total,

inter-crew rotation. A limited but necessary, permanent, shoreside staff, consisting of a Division Commanding Officer, Executive Officer, and Engineering Officer, is needed for coordination. The Division EO and XO should also have a number of permanent, shoreside, personnel to assist them in carrying out their duties.

C. AREAS FOR FURTHER RESEARCH

The study conducted for this paper centered on management and behavioral problems, specifically organizational, attitudinal, and communicational, that have limited the ability of multi-crewed vessels to demonstrate their potential prowess. A more detailed cost benefit analysis should be carried out to verify the practical and economic feasibility of utilizing the concept, and to further identify the strengths and weaknesses associated with such an organization.

Consideration should be given to the level and type of logistic and administrative support that will be needed for general and specific multi-crewed vessel organizations. Administrative issues, such as determining the procedures and repercussions to making the changes needed to current policies that preclude providing the standard messing and seapay benefits to multi-crewed vessels, should be examined. A detailed and complete organization manual should be developed that establishes the framework and policies around which multi-crewed vessels should generally operate. In

terms of logistics, there are numerous questions to be answered. If a vessel is to be multi crewed, the ship itself can no longer serve as home to the non-married, or geographically separated from family, crewmember. This means an examination of shoreside housing alternatives, such as bachelor quarters or leased housing, should be conducted to determine costs and operating procedures. Smaller multi-crewed floating units may be able to have their support needs easily served by the independent units that currently exist for that purpose (Groups, Support Centers, Bases, and Assistance Teams). Larger multi-crewed vessels may need to have their own additional support personnel and facilities.

All of these issues should be examined and resolved prior to establishing multi-crewed vessel organizations.

D. CONCLUSION

As is often the case in developing a paper such as this one, a great deal more data was collected than actually used. The survey included opportunities for respondents to record their own ideas about how the Coast Guard might better organize and utilize our afloat resources. Included among the concepts most frequently suggested were the following:

- Augment vessel crew with shore duty maintenance team, and rotate crewmembers through the team.
- Longer deployments by single-crewed vessels because productivity increases as daily learning takes place.

- Cluster like ships into flotillas/squadrons. Squadron Commander has an administrative, supply, engineering, and training support staff. Crewmembers report to the Squadron Commander upon initial arrival and are permanently assigned to the one vessel with the greatest need.

- Acquire less costly, mission specialized vessels rather than multi-mission vessels.

- Improved funding, training, and support to traditional single crewing.

- Develop a cadre of seagoing specialists.

Many of these innovative and thought-provoking approaches fueled the development and formation of this thesis. All such data has been retained, and is available to any interested party. Perhaps even more encouraging is the confirmation provided by these responses that the leadership talent and determination needed to assure the successful implementation of multi crewing aboard ship, or any other major organizational change the future may hold for the Coast Guard, continues to exist in great abundance within its ranks.

APPENDIX A

U.S. COAST GUARD ORGANIZATION

The United States Coast Guard is an armed service organized in peacetime under the Department of Transportation. In time of war or at the President's order, the Coast Guard operates under the jurisdiction of the United States Navy. The service numbers approximately 40,000 officers and men manning over three hundred ships and aircraft. Its responsibilities include ocean and coastal search and rescue, marine inspection of U.S. vessels, maritime pollution protecton, enforcement of laws and treaties, and boating standards.

The organization of the Coast Guard is described in Figure 3. The area offices are primarily responsible for administrative and planning activities to carry out headquarters programs and policies. District offices primarily control the operational units assigned to them. These various units, except for major afloat commands, are organized into group and station commands.

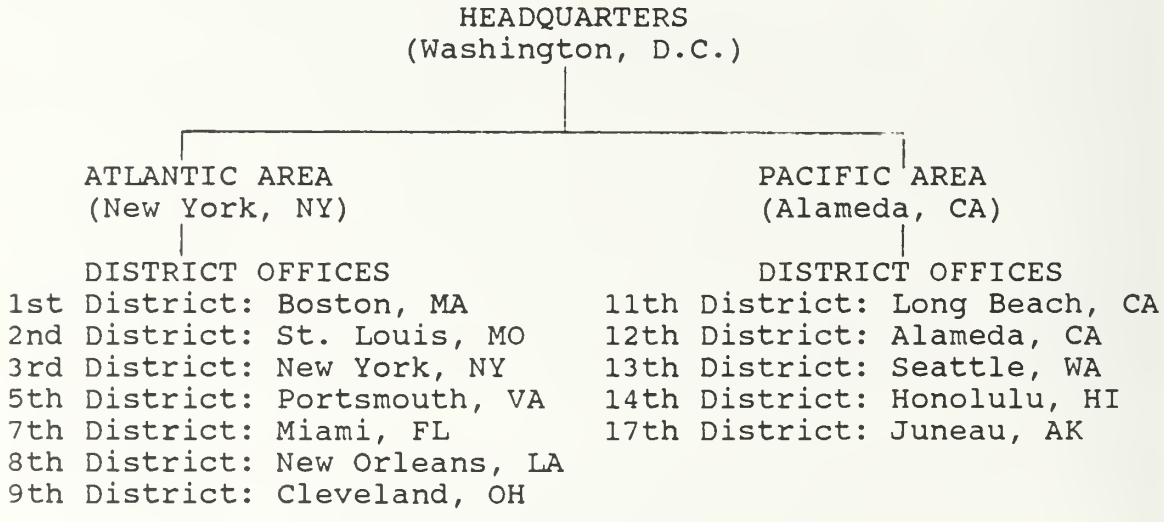

Figure 3. Coast Guard Organization Chart

APPENDIX B

TABLES

TABLE I

WPB RESOURCE HOURS AND OPERATING COSTS--FYS 84/85

Cutter Name	Resource Hours		Operating Costs	
	84	85	84	85
82' Single Crew				
Point Barrow	840	1,062	$297,558	$272,658
Point Chico	952	1,038	249,576	362,924
Point Heyer	1,029	1,094	272,095	387,697
Point Hobart	1,234	1,409	349,050	271,713
Point Ledge	770	805	439,451	495,423
Point Winslow	845	1,126	320,136	256,348
Average Annual	1,017 hrs.		$331,219	
82' Dual Crew[1]				
Point Bridge	2,579	2,470	317,356	379,489
Point Brower	2,459	2,068	265,722	229,292
Point Camden	2,330	2,063	275,083	237,127
Point Divide	2,296	1,740	320,364	329,018
Point Evans	2,268	1,829	343,800	362,600
Point Judith	2,024	2,279	301,988	362,859
Point Stuart	2,457	1,690	205,588	310,152
Average Annual	2,182 hrs.		$302,888	
95' Single Crew				
Cape Fox	2,893	1,747	337,296	474,895
Cape York	2,767	2,080	409,243	360,906
Average nnual	2,372 hrs.		$395,585	
95' Multi Crew				
Cape Current	2,330	2,766	553,884	388,979
Cape Gull	3,124	906	400,341	452,088
Average Annual	2,282 hrs.		$448,823	

[1]Costs of military pay and allowances during FY 85 for dual crewed units were unavailable at the time Table I was developed. FY 84 military pay and allowance costs were used to arrive at the total FY 85 Operating Cost figures for these units.

TABLE II

FY 85 ANNUAL INSPECTION RESULTS FOR WPBS

Cutter Name	Overall all Evaluation	Material Inspection	Naval Engineering	Electronic Engineering	Personnel Inspection
82' Single Crew					
Point Barrow	E	G	G	E	G
Point Chico	O	O	O	G	O
Point Heyer	E	E	G	E	E
Point Hobart	E	E	G	E	E
Point Ledge	U	E	G	G	G
Point Winslow	E	O	E	E	O
82' Dual Crew					
Point Bridge	E	E	O	E	O
Point Browers[2]	O	E	O	O	O
Point Camden	E	E	E	O	E
Point Divide	O	O	O	O	O
Point Evans	E	O	O	E	O
Point Judith	O	O	O	O	O
Point Stuart	O	E	O	O	O
95' Single Crew					
Cape Fox	O	O	O	NR	O
Cape York	E	O	E	NR	O
95' Multi Crew					
Cape Current	E	G	E	NR	O
Cape Gull	E	G/E	G/E	NR	O

O = Outstanding
E = Excellent
G = Good
NR = Not Reported
U = Unsatisfactory

[2]FY 86 Inspection

TABLE III

PREDICTION AND CRITERIA QUESTION RESPONSES

Survey Number	Productivity Pred Q8	Maintanance Pred Q9	Morale Pred Q10	Efficiency Pred Q11	Seniors Pred Q17	Opinion Crit Q13
1	1	2	2	•	1	2
2	1	2	2	1	1	2
3	1	2	2	2	2	2
4	2	2	2	2	2	2
5	2	2	2	2	2	2
6	2	2	2	1	1	2
7	1	1	1	1	1	1
8	1	2	2	1	1	2
9	1	2	2	1	2	1
10	1	2	2	2	2	2
11	1	2	2	1	2	1
12	1	1	1	1	1	1
13	1	1	1	1	1	1
14	2	2	2	2	1	2
15	1	1	2	1	2	1
16	1	2	2	1	1	2
17	1	1	1	1	1	1
18	1	1	1	•	•	1
19	1	2	2	2	1	2
20	1	1	1	1	1	1
21	1	2	2	2	2	2
22	1	2	2	1	2	2
23	1	1	1	1	2	1
24	1	2	2	1	2	1
25	1	1	1	2	•	1
26	1	2	2	2	1	2
27	1	2	2	1	2	2
28	2	2	1	2	2	1
29	2	2	2	2	2	2
30	1	2	2	1	2	2
31	1	2	2	2	2	2
32	1	2	1	1	1	1
33	1	1	1	2	1	2
34	1	1	1	1	•	1
35	2	2	2	2	1	1
36	2	2	2	2	2	1
37	•	•	2	2	2	2
38	1	2	1	2	2	1

1 = Supporter 2 = Opposed • = No Response

Survey Number	Productivity Pred Q8	Maintanance Pred Q9	Morale Pred Q10	Efficiency Pred Q11	Seniors Pred Q17	Opinion Crit Q13
39	1	1	1	1	•	1
40	1	2	1	1	2	2
41	1	1	1	2	1	1
42	1	2	1	1	•	2
43	1	2	1	1	2	1
44	1	2	1	2	1	1
45	2	2	2	1	•	2
46	1	2	2	2	1	2
47	•	•	1	•	•	1
48	2	2	2	1	2	2
49	2	2	2	2	2	2
50	1	1	1	1	1	1
51	2	2	2	2	2	2
52	1	1	1	1	1	1
53	1	2	2	•	1	1
54	1	2	1	2	1	1
55	1	2	2	2	1	2
56	1	2	1	1	2	1
57	1	1	2	1	1	1
58	1	2	2	1	1	1
59	1	2	2	1	•	2
60	1	2	2	1	2	2
61	1	2	2	1	2	2
62	1	1	1	1	1	1
63	2	2	2	2	2	2
64	1	1	1	1	1	1
65	2	2	2	2	1	2
66	1	•	•	1	2	2
67	1	2	•	2	•	2
68	1	2	1	2	1	1
69	1	1	2	1	1	2
70	2	2	2	2	•	2
71	2	2	2	2	•	2
72	1	2	2	2	2	2
73	1	2	2	2	2	2
74	1	1	2	1	1	1
75	1	1	1	2	•	2

1 = Supporter 2 = Opposed • = No Response

TABLE IV

STEPWISE REGRESSION Y_1: OPINION 5 X VARIABLES

Summary Information

F to Enter	4
F to Remove	3.996
Number of Steps	2
Variables Entered	2
Variables Forced	0...0

No Residual Statistics Computed

Note: 16 cases deleted with missing values.

STEP NO. 1 VARIABLE ENTERED: X_3: MORALE

R:	R-squared:	Adj. R-squared:	Std. Error:
.64	.41	.4	.39

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	6.034	6.034	39.633
RESIDUAL	57	8.678	.152	
TOTAL	58	14.712		

STEP NO. 1 Stepwise Regression Y_1: OPINION 5 X variables

Variables in Equation

Parameter:	Value:	Std. Err.:	Std. Value:	F to Remove:
INTERCEPT	.427			
MORALE	.668	.106	.64	39.633

Variables Not in Equation

Parameter:	Par. Corr:	F to Enter:
PRODUCTIVITY	.084	.396
MAINTENANCE	.252	3.809
EFFICIENCY	.277	4.66
SENIORS	.081	.373

(Last Step) STEP NO. 2 VARIABLE ENTERED: X_4: EFFICIENCY

R:	R-squared:	Adj. R-squared:	Std. Error:
.675	.455	.436	.378

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	2	6.701	3.35	23.419
RESIDUAL	56	8.011	.143	
TOTAL	58	14.712		

STEP NO. 2 Stepwise Regression Y_1: OPINION 5 X variables

Variables in Equation

Parameter:	Value:	Std. Err.:	Std. Value:	F to Remove:
INTERCEPT	.18			
MORALE	.626	.105	.6	35.777
EFFICIENCY	.217	.101	.217	4.66

Variables Not in Equation

Parameter:	Par. Corr:	F to Enter:
PRODUCTIVITY	-.025	.034
MAINTENANCE	.168	1.596
SENIORS	.066	.241

APPENDIX C

SURVEY INSTRUMENT

Name/Rank _____
Unit _____

PLEASE CIRCLE THE LETTER THAT DESIGNATES YOUR APPLICABLE RESPONSE

1. What is the total amount of your USCG active duty service?
   a. less than 10 years
   b. 10-15 years
   c. 16-20 years
   d. 21-25 years
   e. more than 25 years

2. What is your primary occupational field?
   a. aviation
   b. surface operations
   c. engineering
   d. administration
   e. other:

3. What is the total amount of your USCG years at sea?
   a. less than one year
   b. 1-3 years
   c. 4-6 years
   d. 7-10 years
   e. more than 10 years

4. Which of the following types of USCG afloat units have you completed tours of duty aboard? CIRCLE ALL THAT APPLY
   a. WAGB
   b. WHEC
   c. WMEC
   d. WLB/WLM
   e. WPB
   f. boats less than 82' in length
   g. others:

5. In what Districts have the USCG afloat units that you have completed tours of duty aboard been homeported? CIRCLE ALL THAT APPLY

   a. 1 c. 3 e. 7 g. 9 i. 12 k. 14
   b. 2 d. 5 f. 8 h. 11 j. 13 l. 17

6. What capacities have you served in during your USCG sea duty? CIRCLE ALL THAT APPLY
   a. CO
   b. XO
   c. EO
   d. OPS
   e. Deck Watch Officer
   f. Engineering Watch Officer
   g. crewmember

THE FOLLOWING QUESTIONS ARE MEANT TO ELICIT YOUR VIEWS REGARDING THE STRENGTHS AND WEAKNESSES OF MULTI-CREWING SHIPS; e.g., rotating three crews through two ships, or four crews through three ships:

7. The concept of multi-crewing ships is feasible.
   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

8. Using resource hours per year as a measure of productivity, how do you compare multi crewing with single crewing, all other things being equal? The multi-crewed vessel will be:
   a. more productive than the single-crewed vessel
   b. equally as productive as the single-crewed vessel
   c. less productive than the single-crewed vessel

9. All other things being equal, how do you compare multi crewing with single crewing in terms of how well the vessel will be maintained (cleanliness, preventive maintenance, appearance)? The multi-crewed vessel will be:
   a. better maintained than the single-crewed vessel
   b. equally as well maintained as the single-crewed vessel
   c. not as well maintained as the single-crewed vessel

10. All other things being equal, how do you compare multi crewing with single crewing in terms of crew morale? The multi-crewed vessel will have:
   a. higher morale than the single-crewed vessel
   b. morale similar to that of the single-crewed vessel
   c. lower morale than the single-crewed vessel

11. Using dollar costs per resource hour as a measure of efficiency, how do you compare multi crewing with single crewing, all other things being equal? The multi-crewed vessel will be:
    a. more efficient than the single-crewed vessel
    b. equally as efficient as the single-crewed vessel
    c. less efficient than the single-crewed vessel

12. If you were the Commandant, and had to decide how to gain additional utility from current afloat resources at minimal cost, how would you do it?
    a. require more time underway from single-crewed vessels
    b. use augmented crews on vessels
    c. use two complete crews per vessel
    d. use multiple crews rotating through multiple vessels
    e. a better configuration might be:

13. How do you feel about multi crewing?
    a. I strongly support it
    b. I support it
    c. I am willing to try it
    d. I oppose it
    e. I strongly oppose it

14. List the three major strengths you see in the multi-crewing of ships.
    1.
    2.
    3.

15. List the three major weaknesses you see in the multi-crewing of ships.
    1.
    2.
    3.

16. Are there any weaknesses you listed in your response to question number 15 that you think are insurmountable? Which ones and why?

    _____

    _____

    _____

17. How do you think officers senior to you in the chain of command feel about the multi-crewing of ships?
    a. they strongly support it
    b. they support it
    c. they are willing to try it
    d. they oppose it
    e. they strongly oppose it

18. Please provide your rationale for your response to question number 12.

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